This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{52900}{100}}$$

The solution is Integer, which is option B.

A. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

B. Integer

* This is the correct option!

C. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

D. Irrational

These cannot be written as a fraction of Integers.

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -230.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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2. Simplify the expression below and choose the interval the simplification is contained within.

$$13 - 3^2 + 2 \div 11 * 12 \div 19$$

The solution is 4.115, which is option A.

A. $[4.09, 4.14]$

* 4.115, this is the correct option

B. $[21.99, 22.07]$

22.001, which corresponds to two Order of Operations errors.

C. $[22.11, 22.5]$

22.115, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

D. $[3.74, 4.09]$

4.001, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-5 - 3i)(6 + 9i)$$

The solution is $-3 - 63i$, which is option A.

A. $a \in [-7, 0]$ and $b \in [-66, -61]$

* $-3 - 63i$, which is the correct option.

B. $a \in [-62, -56]$ and $b \in [24, 33]$

$-57 + 27i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-62, -56]$ and $b \in [-27, -22]$

$-57 - 27i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-34, -25]$ and $b \in [-27, -22]$

$-30 - 27i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

E. $a \in [-7, 0]$ and $b \in [58, 68]$

$-3 + 63i$, which corresponds to adding a minus sign in both terms.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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4. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-5 - 8i)(-3 + 7i)$$

The solution is $71 - 11i$, which is option E.

A. $a \in [-43, -35]$ and $b \in [-59, -58]$

$-41 - 59i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-43, -35]$ and $b \in [56, 61]$

$-41 + 59i$, which corresponds to adding a minus sign in the second term.

C. $a \in [13, 17]$ and $b \in [-57, -49]$

$15 - 56i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

D. $a \in [69, 72]$ and $b \in [7, 12]$

$71 + 11i$, which corresponds to adding a minus sign in both terms.

E. $a \in [69, 72]$ and $b \in [-12, -7]$

* $71 - 11i$, which is the correct option.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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5. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{9}{-7} + 25i^2$$

The solution is Rational, which is option D.

A. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

B. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

C. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

D. Rational

* This is the correct option!

E. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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6. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{1936}{0}} + \sqrt{154}i$$

The solution is Not a Complex Number, which is option A.

A. Not a Complex Number

* This is the correct option!

B. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

C. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

D. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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7. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{25}{0}}$$

The solution is Not a Real number, which is option A.

A. Not a Real number

* This is the correct option!

B. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

C. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

D. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{\frac{25}{0}}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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8. Simplify the expression below and choose the interval the simplification is contained within.

$$1 - 16 \div 12 * 18 - (15 * 8)$$

The solution is -143.000, which is option A.

A. $[-143, -138]$

* -143.000, which is the correct option.

B. $[-306, -303]$

-304.000, which corresponds to not distributing a negative correctly.

C. $[117.93, 121.93]$

120.926, which corresponds to not distributing addition and subtraction correctly.

D. $[-122.07, -113.07]$

-119.074, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-27 + 44i}{1 + 6i}$$

The solution is $6.41 + 5.57i$, which is option A.

A. $a \in [4, 7.5]$ and $b \in [5, 6]$

* $6.41 + 5.57i$, which is the correct option.

B. $a \in [236.5, 237.5]$ and $b \in [5, 6]$

$237.00 + 5.57i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [-8.5, -7]$ and $b \in [-4, -2]$

$-7.86 - 3.19i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [4, 7.5]$ and $b \in [205, 207]$

$6.41 + 206.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-27.5, -26.5]$ and $b \in [6, 8.5]$

$-27.00 + 7.33i$, which corresponds to just dividing the first term by the first term and the second by the second.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{54 + 77i}{-4 + 5i}$$

The solution is $4.12 - 14.10i$, which is option E.

A. $a \in [-15, -14]$ and $b \in [-1.5, -0.5]$

$-14.66 - 0.93i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [4, 4.5]$ and $b \in [-579, -577]$

$4.12 - 578.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [168.5, 169.5]$ and $b \in [-16, -14]$

$169.00 - 14.10i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-14, -12.5]$ and $b \in [15, 16]$

$-13.50 + 15.40i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [4, 4.5]$ and $b \in [-16, -14]$

* $4.12 - 14.10i$, which is the correct option.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.
